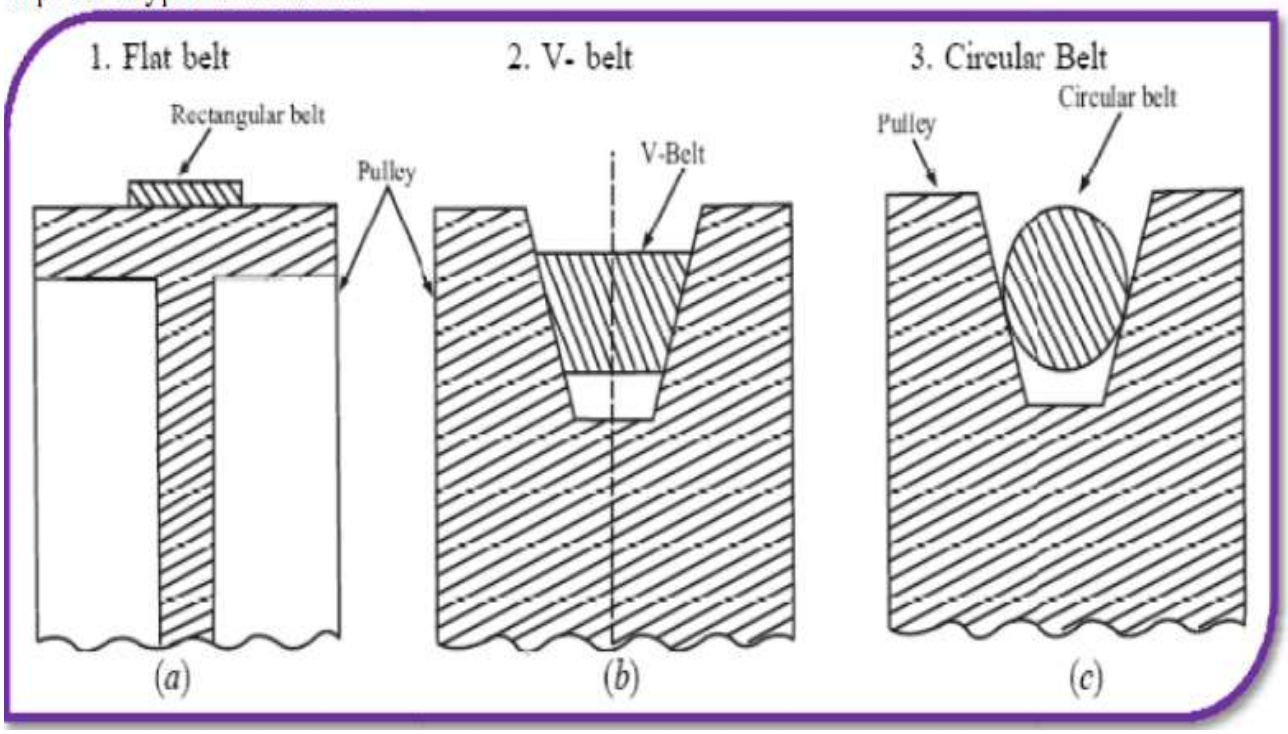
BELTS

A belt used to transmit power forms one shaft to anther By pulley .

Types of Belts:

Important types of belts are:



Flat Belt:

The flat belt is mostly used in the factories and workshops. It is used where a moderate amount of power is to be transmitted, from one pulley to another, when the two pulleys are not more than 10m apart.

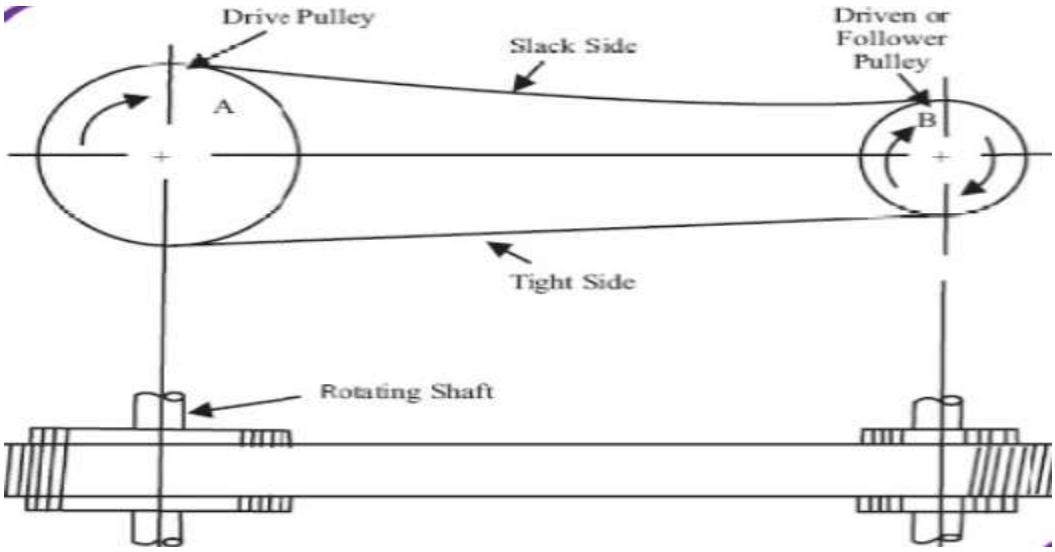
V-Belt:

The V-belt is mostly used where a great amount of power is to be transmitted, from one pulley to another, when the two pulleys are very near to each other.

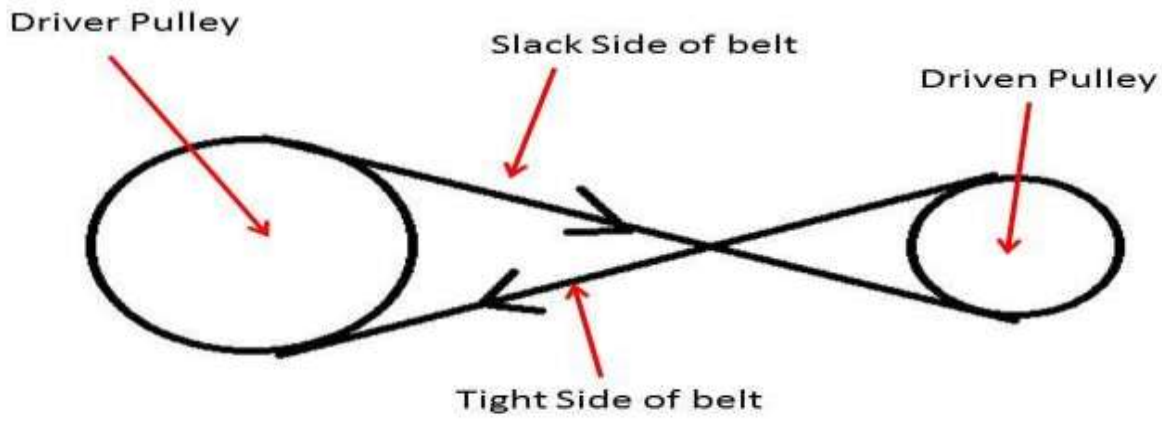
Circular Belt or Rope:

The circular belt or rope is mostly used where a great amount of power is to be transmitted from one pulley to another, when the two pulleys are more than 5m apart.

Open belt drive:-



2- cross belt drive:-



Cross Belt Drive

d1=diameter of the driver.
d2= diameter of the follower.
N1= speed of the driver(r.p.m).
N2=speed of the follower(r.p.m).
Length of the belts (driver) = $\pi d1N1$
Length of the belt(follower) = $\pi d2N2$
In one time ;-

Length passes over driver= Length passes over follower

$\pi d1N1 = \pi d2N2$

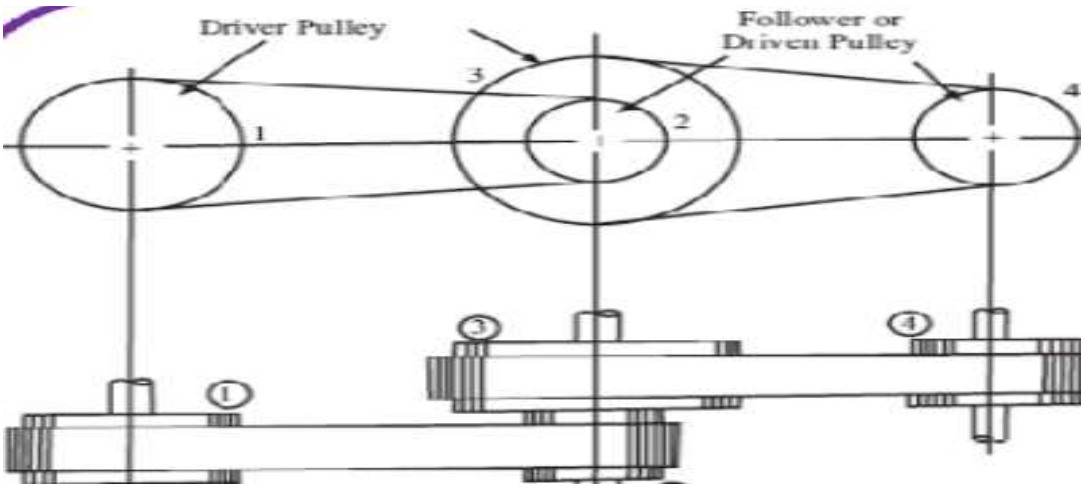
$d1N1 = d2N2$ ----------(1)

$\frac{N1}{N2} = \frac{d2}{d1}$—(velocity ratio)-(2).

Or-

$=\frac{d1+t}{d2+t}$ – – – – – – – – – – – – – (3).

Compound belts:-



Where:- $\frac{N1}{N2} = \frac{d2}{d1}$—(velocity 1:2).----------(1)

$\frac{N4}{N3} = \frac{d3}{d4}$ (velocity 3:4).---------(2)

Multiplying equation (1) (2) are-

$\frac{N1}{N2} X \frac{N4}{N3} = \frac{d2}{d1} X \frac{d3}{d4}$

$\frac{N4}{N1} = \frac{d1}{d2} \frac{x\, d3}{xd4}$ – – – – – – – –(3).

Slip of the belt:-

S1% slip between the driver & the belt .

S2% slip between the follower &the belt .

$$\pi d1\ N1 = \pi d1\ N1 - \frac{S1}{100}\ (\pi d1\ N1) - -(4)$$

$$= \pi d1\ N1\ \left(1 - \frac{S1}{100}\right) \text{----------(5)}$$

$$\pi d2\ N2 = \pi d2\ N2 - \frac{S2}{100}\ (\pi d2\ N2) - - - -(6)$$

$$= \pi d2\ N2\ \left(1 - \frac{S2}{100}\right) \text{----------} \quad (7)$$

$$\pi d1\ N1 = V1 = V1 - \left(\frac{S1}{100}\right)$$

$$\pi d2\ N2 = V2 = V2 - \left(\frac{S2}{100}\right)$$

Substituting (V2) from (V1)-

$$\pi d2\ N2 = \pi d1\ N1\ \left(1 - \frac{S1}{100}\right)\left(1 - \frac{S2}{100}\right) \text{----------(8)}$$

$$\frac{N1}{N2} = \frac{d2}{d1}\left(1 - \frac{d2}{d1}\right)\left(1 - \frac{S2}{100}\right) \text{----------(9)}$$

$$= \frac{d2}{d1}\left(1 - \left(\frac{S1 + S2}{100}\right)\right) \text{---------- (10)}$$

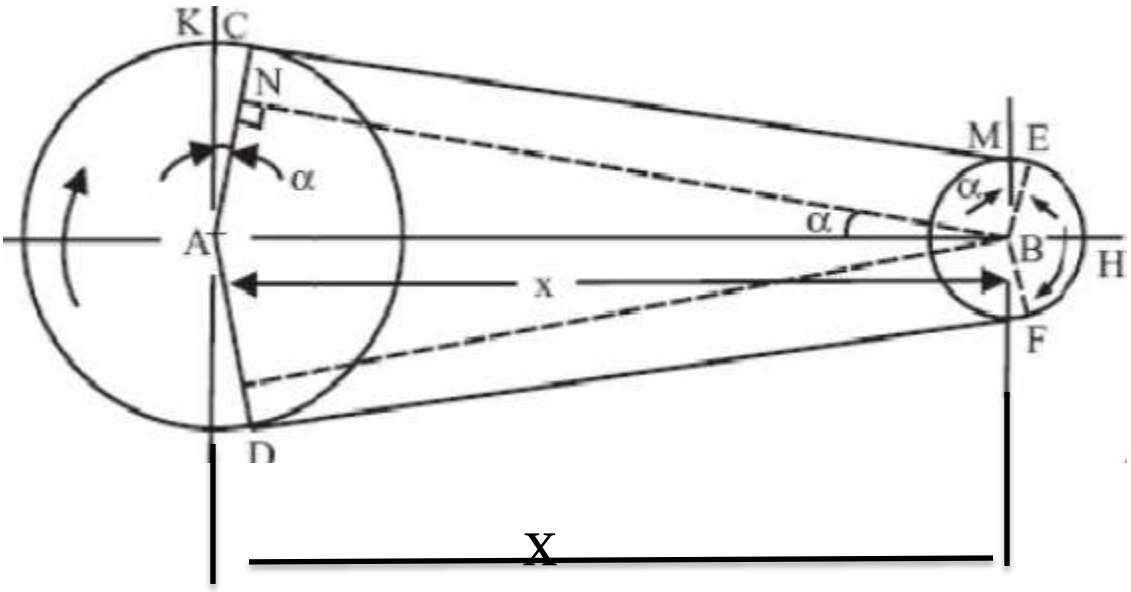
$$= \frac{d2}{d1}\left(1 - \frac{S}{100}\right) \text{----------(11)}$$

$$= \frac{d2+t}{d1+t}\left(1 - \frac{S}{100}\right) \text{----------} \quad (12)$$

S=total percentage slip.

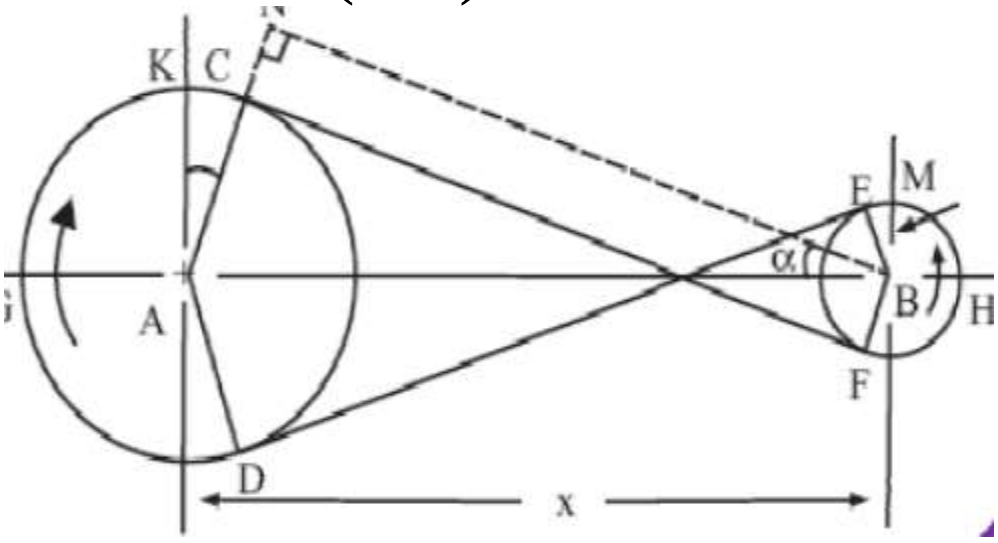
Length of the belt:-

Open:-



$$L=\varepsilon\,\pi(r1+r2)=2X+(\frac{r1-r2}{X})^{2}--(1).$$

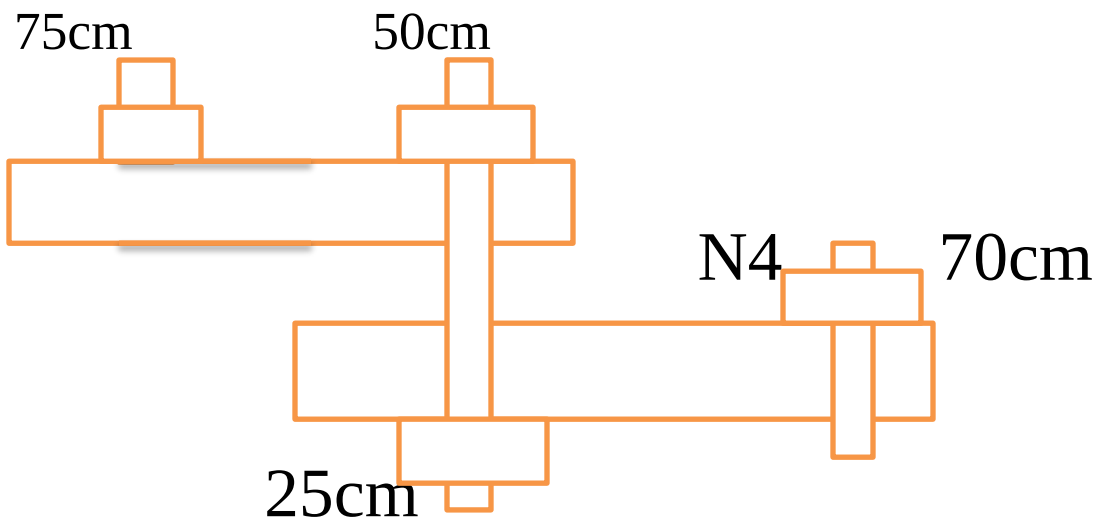
A -center of driver pulley.
B-center of follower.
R2- radial of follower.
R1-radial of driver.
X=distance between (A- B).



Closed-

$$L=\varepsilon\,\pi(r1+r2)=2X+(\frac{r1+r2}{X})^{2}--(2).$$

Ex1-:-in engine .running at (180 rpm) drives. a shaft by Belt. The diameter of the engine pulley .and the shaft pulley Are(50- 25 cm).another pulley of (70cm)diameter of the same Shaft drives (280 cm).Find the end of velocity.



Sol:

d1=50 cm d2=25cm d3=70cm
N1=180 rpm.

$$\frac{N4}{180} = \frac{d1 \quad x \quad d3}{d2 \quad x \quad d4} = \frac{50 \quad x \quad 75}{25 \quad x \quad 70}$$

N4=900 rpm.

Ex2:-Find the length of the belt used to driver pulley (80cm Diameter running parallel of a distance of (12m) from The drive pulley of a diameter(480cm).

Sol:- d2= 80cm r2=40cm=
X= 12m X=12000cm
d1= 480cm r1=240 cm

open:-

$$L = \varepsilon\,\pi(r1 + r2) = 2X + \left(\frac{r1 - r2}{X}\right)^2 .$$

$$= \varepsilon\,\pi(240 + 40) = 2x1200 + \left(\frac{240 - 40}{1200}\right)^2 .$$

=33.45cm.

Closed:-

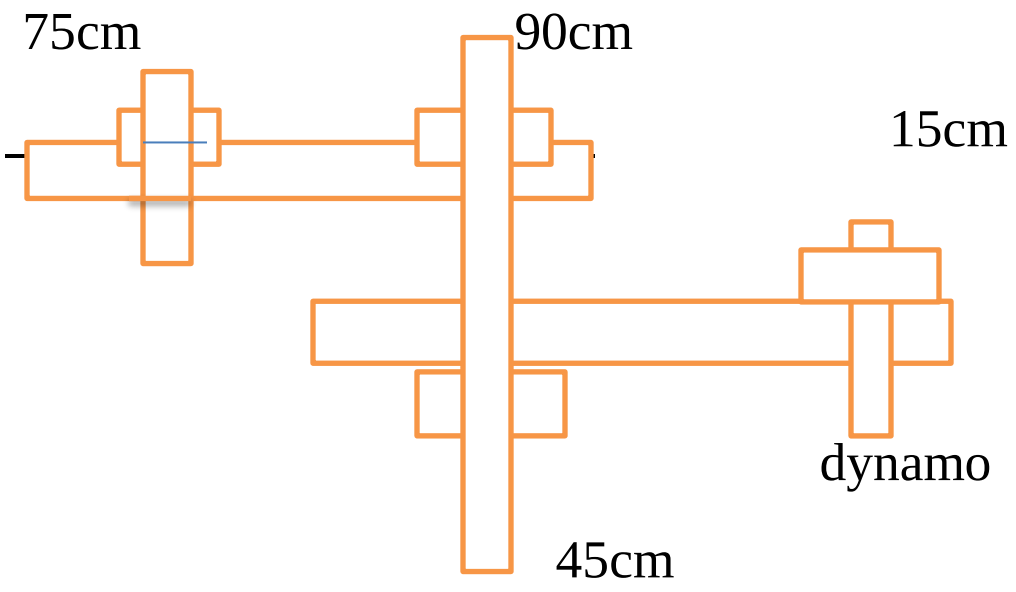
$$L = \varepsilon\,\pi(r1 + r2) = 2X + \left(\frac{r1 + r2}{X}\right)^2 .$$

$$= \varepsilon\,\pi(240 + 40) = 2x1200 + \left(\frac{240 + 40}{1200}\right)^2 .$$

=33.133 cm

Ex3:-

An engine .running at(150 rpm) driver aline shaft by means Of the abelt.the engine pulley is (75cm)diameter and the pulley On line shaft (45cm).a(90cm)diameter pulley on the line shaft Drivers (15cm)diameter .pulley keyed by the dynamo .
Find –the speed of the shaft when (there is no slip) (slip2%)



Sol:-

No slip $\frac{N4}{N1} = \frac{d1 \quad x \quad d3}{d2 \quad x \; d4}$

$\frac{N4}{150} = \frac{75 \quad x \quad 90}{45 \quad x \; 15}$ N4=1500 rpm.

Slip2% $\frac{N4}{150} = \frac{75 \quad x \quad 90}{45 \quad x \; 15}\left(1- \frac{S1}{100}\right)\left(1- \frac{S2}{100}\right)$

$\frac{N4}{150} = \frac{75 \quad x \quad 90}{45 \quad x \; 15}\left(1- \frac{2}{100}\right)\left(1- \frac{2}{100}\right)$

$\frac{N4}{150} = \frac{75 \quad x \quad 90}{45 \quad x \; 15}\left(\frac{98}{100}\right)\left(\frac{98}{100}\right)$

N4=1440 rpm.
